

WHAT IS CLAIMED IS:

1. A semiconductor product comprising:
a low-k dielectric layer;
5 a nitrogen base layer including N-H base groups capable of diffusing therefrom;
and
an oxygen-containing layer interposed directly between said low-k dielectric layer
and said nitrogen base layer.

10 2. The semiconductor product as in claim 1, wherein said oxygen-containing
layer comprises a TEOS (tetraethyl orthosilicate) oxide film.

15 3. The semiconductor product as in claim 2, wherein said nitrogen base
layer comprises one of a silicon nitride film and a nitrogen-doped silicon carbide film.

4. The semiconductor product as in claim 1, wherein said nitrogen base
layer comprises one of a nitrogen-containing barrier layer film, a nitrogen-containing
etch-stop layer, and a hardmask film.

20 5. The semiconductor product as in claim 1, wherein said oxygen-containing
layer comprises oxygen-doped silicon carbide.

25 6. The semiconductor product as in claim 1, wherein said nitrogen base
layer comprises a surface of a further film including N-H base groups thereon.

7. The semiconductor product as in claim 1, in which said semiconductor product includes:

a lower low-k dielectric layer disposed over a barrier layer;

an etch-stop layer disposed over said lower low-k dielectric layer;

an upper low-k dielectric layer disposed over said etch-stop layer;

a hardmask layer disposed over said upper low-k dielectric layer;

said nitrogen base layer comprising one of said barrier layer and said etch-stop layer; and

said oxygen-containing layer comprising a TEOS oxide layer interposed between said nitrogen base layer and one of said lower low-k dielectric layer and said upper low-k dielectric layer.

8. The semiconductor product as in claim 7, further comprising each of said barrier layer, said etch-stop layer and said hardmask layer being a nitrogen base layer including N-H base groups capable of diffusing therefrom, and a TEOS oxide layer interposed between each said nitrogen base layer and each said adjacent low-k dielectric layer.

9. The semiconductor product as in claim 7, wherein said barrier layer comprises one of nitrogen-doped silicon carbide and silicon nitride, and said etch-stop layer comprises one of nitrogen-doped silicon carbide and silicon nitride.

10. The semiconductor product as in claim 1, wherein said N-H base groups comprise one of amines and amino-silicates.

11. The semiconductor product as in claim 1, wherein said low-k dielectric layer includes a dielectric constant less than 3.5.

12. The semiconductor product as in claim 1, wherein said low-k dielectric
5 layer comprises one of an organo-silicate-glass and SiOC-H.

13. A semiconductor product comprising:

a barrier layer formed over a substrate;

a lower low-k dielectric layer formed over said barrier layer;

an etch-stop layer formed over said lower low-k dielectric layer;

an upper low-k dielectric layer formed over said etch-stop layer;

a hardmask layer disposed over said upper low-k dielectric layer; and

a TEOS (tetraethyl orthosilicate) oxide film interposed at least one of between
said lower low-k dielectric layer and said barrier layer, between said lower low-k
dielectric layer and said etch-stop layer, between said etch-stop layer and said upper
low-k dielectric layer, and between said upper low-k dielectric layer and said hardmask.

14. The semiconductor product as in claim 13, wherein each of said barrier
layer and said etch-stop layer include N-H base groups therein.

15. The semiconductor product as in claim 13, in which a two-tiered opening
is formed to extend through said hardmask layer, said upper low-k dielectric layer, said
etch-stop layer, said lower low-k dielectric layer, and said barrier layer.

16. The semiconductor product as in claim 15, further comprising a conductive material filling said two-tiered opening, said conductive material serving as an interconnect medium.

5 17. The semiconductor product as in claim 13, in which an opening is formed to extend through said hardmask layer, said upper low-k dielectric layer, said etch-stop layer and said lower low-k dielectric layer, and further comprising a DUV photoresist formed within said opening.

10 18. A process for forming a semiconductor product, comprising:
forming at least one low-k dielectric film over a substrate;
forming at least one N-H base source film over said substrate using a source chemistry including ammonia; and
forming a TEOS oxide film using tetraethyl orthosilicate and oxygen, directly
15 between at least one adjacent set of said low-k dielectric film and said N-H base source film, thereby forming a film stack.

20 19. The process as in claim 18, in which said process includes forming a lower low-k dielectric film over said substrate, forming a first TEOS oxide film over said lower low-k dielectric film, forming an etch-stop layer of silicon nitride over said first TEOS oxide film, forming a second TEOS oxide film over said etch-stop layer, forming an upper low-k dielectric film over said second TEOS oxide film, forming a third TEOS oxide film over said upper low-k dielectric film, and forming a hardmask film over said third TEOS oxide film.

20. The process as in claim 18, further comprising forming an opening extending through said film stack and introducing a DUV photoresist into said opening.

21. The process as in claim 20, further comprising patterning and etching to
5 convert said opening to a dual-damascene opening, then filling said dual-damascene opening with a conductive material.

22. The process as in claim 18, in which said forming at least one N-H base source film includes forming a nitrogen-containing etch-stop layer.

23. The process as in claim 18, in which said forming at least one N-H base source film comprises forming one of a silicon nitride film and a nitrogen-doped silicon
10 carbide film.

24. The process as in claim 18, in which said forming a TEOS oxide film comprises plasma enhanced chemical vapor deposition.

25. The process as in claim 19, in which said substrate includes a barrier film thereon, said barrier film comprising one of a silicon nitride film and a nitrogen-doped
20 silicon carbide film, and further comprising forming a bottom TEOS oxide film over said barrier film and in which said lower low-k dielectric film is formed on said bottom TEOS oxide film.